VI

A TOOTH OF HIPPARION MOHAVENSE FROM THE PUENTE FORMATION, CALIFORNIA

BY CHESTER STOCK

WITH ONE FIGURE

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Contribution No. 2 2

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Remains of land mammals occurring in Tertiary formations of the Pacific Coast marine province of western North America furnish important data relating to the correlation of the faunal horizons of this region with those of the continental deposits of the Great Basin area to the east. The discovery in marine deposits, presumably the Puente formation of southern California, of a horse tooth identified as belonging to the species *Hipparion mohavense* Merriam, suggests at once an interesting time relationship between the Puente and the Ricardo deposits of the Mohave desert, the type locality of this species.

The tooth, No. A1331 Los Angeles Mus. Coll., was obtained by Dr. A. J. Tieje. The specimen occurred in diatomaceous shale at a locality 2.5 miles from Covina and in a direction S 77° E of the center of this community as determined on the topographic map, Pomona Quadrangle, California, of the U. S. Geological Survey.

The San Jose Hills in which the locality occurs are shown on the geological map recently published by English [1] to be largely constituted by the upper division of the Puente formation of upper Miocene age. As described by English the sedimentary deposits in the San Jose Hills represent a succession of alternating shale, sandstone and conglomerate. The particular area in which the *Hipparion* tooth was found is mapped as the upper shale member of the Puente.

English considers it possible that a portion of this shale and conglomerate series regarded as the upper Puente belongs to the Fernando, but states that "in the absence of any evidence of unconformity there is no reason to place the dividing line at any particular horizon, and as the shale zones are more like the Puente shales it seems best to include all the beds in that formation." Elsewhere in the area mapped by English the Fernando Pliocene rests unconformably above the Puente and differs lithologically from the latter in general absence of siliceous shales, in a greater abundance of conglomerates, and in the slightly less indurated state of the deposits. It is conceded, however, that there are several localities where the two formations can not be differentiated on the basis of these lithological characters.

[1] Walter A. English, *Geology and oil resources of the Puente Hills region, southern California; with a section on the chemical character of the oil*, by Paul W. Prutzman, U. S. Geol. Surv. Bull. 768, 1926.

The tooth (fig. 1) is not water worn and does not appear to have been transported for any great distance. The specimen belongs to the upper premolar series, representing presumably P4. No. A1331 resembles in size and in its enamel pattern premolar teeth of *Hipparion mohavense* from the Ricardo beds, Mohave Desert, California. The plications of the fossette borders appear to be very much like those of *H. mohavense*. This is especially true of the posterior border of the prefossette and of the anterior border of the postfossette. A single pli caballin is present. The discrete protocone closely resembles in size and in shape that in the Ricardo species. The meso-style is rather strongly developed. A heavy deposit of cement is present on the outer and inner sides of the tooth and reaches upward to a point approximately 8 mm. above the occlusal surface.

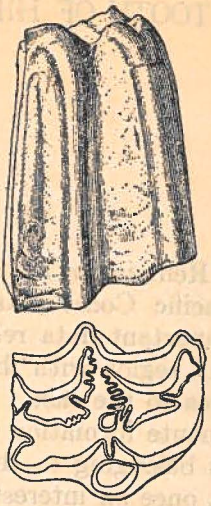

FIG. 1—*Hipparion mohavense* Merriam. . P4?, view of occlusal surface and outer side, ×1.0. Upper Puente deposits, San Jose Hills, near Covina, California.

The anteroposterior diameter of P4, No. A1331, taken normal to the longitudinal axis of the tooth is 23.5 mm., while the transverse diameter is 22.4 mm. The greatest diameter of the protocone is 6.5 mm.

There appears to be no reason for questioning the close similarity or identity in stage of evolution which exists between the Puente *Hipparion* and *H. mohavense* of the Ricardo beds. The Ricardo fauna has been regarded as lower Pliocene in age. In recent years, however, the assemblage has been considered as belonging perhaps to the late Miocene rather than to the early Pliocene.[2] It is worthy of note that the age determination of the Ricardo is in part based upon the presence of *Hipparion* horses showing relationship to Old World representatives of this group occurring in the Pontian stage.

Prior to the discovery of the *Hipparion* tooth the Puente formation in the area mapped by English yielded no diagnostic fossils on which an age determination of this deposit could be based. The age of the formation was suggested by the fact that the Puente lies between the middle Miocene Topanga and the Pliocene Fernando. The occurrence of *Hipparion mohavense* in beds of the upper portion of the Puente furnishes evidence that the deposits are either lower Pliocene or uppermost Miocene in age. If we accept the view that the genus *Hipparion* appeared in North America in the late Miocene, then the presence of *H. mohavense* in the Puente would lend further support to this view,

[2] For a recent discussion of the correlation and age of the Ricardo fauna see C. Stock and E. L. Furlong, Univ. Calif. Publ., Bull. Dept. Geol. Sci., vol. 16, pp. 51–53, 1926.

since the Puente has been correlated with upper Miocene formations rather than with lower Pliocene deposits on the basis of independent stratigraphic evidence.

Support of this view is, however, lessened somewhat by the fact that the upper Puente deposits in the San Jose Hills may belong, as stated above, to the Fernando marine formation of Pliocene age, a possibility suggested by English. Should this prove to be the case the presence of an *Hipparion* tooth in these beds might then be regarded as evidence confirming the Pliocene age of these deposits, particularly if we grant the lower Pliocene age of the Ricardo fauna. The Fernando in the area mapped by English is considered as being middle Pliocene in age. This determination is based upon the relationship of the marine invertebrate fauna to that of the Fernando in adjacent regions. The occurrence of *Hipparion mohavense* in the Fernando should then be regarded as the result of survival of the species in the middle division of the Pliocene.

In the later Pliocene faunas of the Great Basin region the *Hipparion* horses are principally if not entirely of the *Neohipparion* type with elongate protocone in the upper teeth. In the California province, species with shortened and rounded protocone, possibly related to *H. mohavense*, have been recorded from the Siestan Pliocene of the Berkeley Hills.

While insufficiency of vertebrate material from the locality in the San Jose Hills and the questionable age determination of the upper Puente deposits in this region leave much to be desired in the correlation of the formation with continental deposits of the Great Basin, the occurrence of *Hipparion mohavense* in beds associated with marine formations in southern California possesses considerable interest, since it further suggests the possibility of an appearance of the *Hipparion* group in the late Miocene of California.